INDOOR AIR QUALITY REASSESSMENT

Burlington High School
123 Cambridge Street
Burlington, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program
January 2006

Background/Introduction

At the request of a parent, the Massachusetts Department of Public Health (MDPH), Center for Environmental Health (CEH) conducted an indoor air quality evaluation at the Burlington High School (BHS), 123 Cambridge Street, Burlington, Massachusetts. Concerns about environmental conditions within the building prompted the assessment.

The BHS was visited on three occasions by CEH staff. On July 27, 2005, Michael Feeney, Director of Emergency Response/Indoor Air Quality (ER/IAQ), CEH, conducted a walk-through of the building interior and examined exterior walls and the crawlspace beneath the building. Heidi Porter, Environmental Engineer for the Burlington Board of Health, accompanied Mr. Feeney during this initial walk-through. Mr. Feeney and Ms. Porter returned to the BHS on September, 30, 2005, to begin air sampling and in-depth examination of classrooms. On December 8, 2005, Mr. Feeney and Ms. Porter accompanied by Sharon Lee, Environmental Analyst, ER/IAQ Program, returned to the building to complete the assessment.

The BHS is a cement and brick structure (Picture 1) that was built in the early to mid 1970s. The complex consists of five large wings that are set on sloping land. Each wing is connected by two long, sloping cement corridors (Picture 2). The heating, ventilating and air conditioning (HVAC) system provides both heating and cooling. Windows are openable in selected areas throughout the building.

The ceiling of each classroom is constructed of pre-stressed concrete slabs that form a corrugated structure that also serves as the roof deck (Picture 3). The underside of this cement deck rests on top of the cinderblock hallway walls of each classroom. The space between the classroom hallway walls and the roof deck is sealed with gypsum wallboard (GW) (Picture 4).

The suspended ceiling in the BHS hallways consists of a tamper-resistant metal grate system (Picture 5). In efforts to attenuate hallway noise and reverberation, a suspended ceiling in the BHS hallways is placed on top of each metal grate.

Actions on Recommendations Previously Made by MDPH

MDPH staff had previously visited the building in February 1997. A report was issued making recommendations to improve indoor air quality (MDPH, 1997). A summary of actions taken to respond to previous recommendations is included as Appendix A of this reassessment.

Methods

Air tests for carbon dioxide, temperature, relative humidity and carbon monoxide were taken with the TSI, Q-Trak™, IAQ Monitor Model 8551.

Results

The BHS has a student population of nearly 1,000 students and a faculty and staff of 120. The tests were taken under normal operating conditions. Test results appear in Tables 1 and 2.

Discussion

Ventilation

It can be seen from the tables that carbon dioxide levels were above 800 parts per million (ppm) parts of air in 11 of 32 areas sampled on September 30, 2005 (Table 1), and 6 of 74 areas sampled on December 8, 2005 (Table 2), indicating adequate air exchange in the majority of areas surveyed during each day of testing. Please note that a number of these measurements were taken in areas with little or no occupancy or in hallways, which are transient areas (Tables 1 and 2). With minimal occupancy and an adequate supply of fresh air by ventilation equipment, carbon dioxide levels in the building would be expected to be near outdoor levels. With an increased population, carbon dioxide levels would be expected to increase.

Fresh air is provided by air handling units (AHUs) located in rooftop penthouses (Picture 6). The AHUs are connected to ducts that were originally connected to wall-mounted air diffusers. Each of these diffusers were installed in the space between the interior wall and roof decking, in essence directing air down the channel created by the roof deck. Ducted exhaust vents were also installed in this manner, side by side with the fresh air supplies. This configuration likely created the condition of short circuiting, where fresh air delivered to a classroom is readily drawn back into an exhaust vent with minimal mixing in the room. In an effort to improve air mixing in classrooms, the supply vents were extended, which now terminate at a four-way, ceiling-mounted, fresh air supply diffuser (Picture 7).

In order to have proper ventilation with a mechanical supply and exhaust system, these systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. According to Craig Robinson, Director of Finance and Operations, Burlington Public Schools, the HVAC system was last balanced when the fresh air diffusers were extended several years ago. It is recommended that existing ventilation systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994).

The Massachusetts Building Code requires that each area have a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (SBBRS, 1997; BOCA, 1993) in office space. The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please consult Appendix B.

Temperature measurements were in a range of 67° F to 73° F on September 30, 2005, and 69° F to 78° F on December 8, 2005, which were slightly below the lower limit MDPH recommended comfort range in some areas. The MDPH recommends that indoor air temperatures be maintained in a range of 70° F to 78° F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

The relative humidity in the building ranged from 32 to 40 percent on September 30, 2005 and 7 to 17 percent on December 8, 2005. These relative humidity ranges were below the MDPH recommended comfort range in all areas sampled. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels would be expected to drop during the winter months, due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

The BHS has had a history of chronic roof leaks, as denoted in the 1997 IAQ assessment (MDPH, 1997). Since the previous MDPH IAQ assessment, a number of actions were taken to reduce leaks at BHS, as reported by Mr. Robinson:

- Carpeting in the library and the annex were replaced. Walls in these areas were cleaned of water damage.
- Window systems were repaired.
- Roof flashing was repaired.
- Various sections of the roof were repaired. This activity has been done as funding is made available; hence, some sections still need repair (personal conversation with Craig Robinson, Director of Finance and Operations, Burlington Public Schools, 2005).

Water damaged ceiling tiles were observed in a number of classrooms. While the ceiling tiles did not appear to be colonized with mold, water damaged ceiling tiles should be replaced. As reported by BHS faculty, a number of hallway areas have leaks during rainstorms where containers are used to capture water. Water damaged pipe insulation was observed in the boy's locker room (Picture 8). A number of water damaged boxes were located in the science room (Picture 9) and a number of hallway areas had water damage, producing rust (Picture 10). As denoted in the previous MDPH IAQ assessment, leaks from the roof/flashing would accumulate on top of the metal suspended ceiling, creating rusting. Water damaged carpeting was also noted in an office area off of the main library area (Picture 11).

The American Conference of Governmental Industrial Hygienists (ACGIH) and the U.S. Environmental Protection Agency (US EPA) recommends that porous materials (e.g., ceiling tiles, cardboard, pipe insulation and carpeting be dried with fans and heating within ***24 to 48 hours of becoming wet*** (ACGIH, 1989; US EPA, 2001). If carpets are not dried within this time frame, mold growth may occur. Water-damaged carpeting cannot be adequately cleaned to remove mold growth.

Two unvented clothes dryers were observed in room 375 (Nutrition), which results in dryer exhaust pollutants being vented into the classroom (Picture 12). Dryers should be vented to the outside of the building. Clothing dryers are a source of water vapor, lint and dusts which can be irritating to certain individuals. Of note were vents in the ceiling of the home economics rooms found open to the outdoors that may have previously been used as dryer exhaust vents (Pictures 13 and 14). Open vents to the outdoors can be a source of unconditioned air and moisture in summer months.

Other Concerns

A number of other conditions that can potentially affect indoor air quality were seen during the assessment. The art department uses kilns to fire pottery (Picture 15). Each kiln is connected into a common vent with a spray booth in the kiln room. In this configuration, it is possible that pollutants produced during kiln operation migrate through the spray booth into the kiln room. Of concern is the presence of the kiln room exhaust vents that are likely part of the general HVAC system (Picture 16). The best practice for ventilation of kilns is to have each kiln connected to a separate dedicated exhaust vent. In addition, the possibility of fire exists if a flammable material is used in the spray booth while a kiln is operating. Kilns pollutants such as waste heat, clay particles and glaze components need to be vented outdoors.

Of note is the condition of the interior classroom hallway walls. As described previously, fresh air supply and exhaust vents are installed in GW inserted between the classroom interior hallway wall and ceiling. The GW serves as the separation for the classroom interior and ceiling plenum above the hallway suspended ceiling. In a number of classrooms, the GW was damaged (Picture 17), missing (Picture 18) or repaired by inserting ceiling tiles cut to size (Picture 19). In this condition, air from the hallway plenum may migrate into the classrooms through these breaches. As discussed previously, the hallway ceiling system is likely to have significant accumulation of dust and other debris that has settled on top of the fiberglass insulation packets. Areas outside the heating/air-conditioned space (e.g., ceiling plenums) should be separated from occupied areas.

Also of note is the condition of the flameproof cabinet in the chemical storeroom. A selection of flammable materials were stored within this cabinet. The bung-hole covers were removed from the cabinet (Picture 20) and a flexible hose was connected to a vent in the ceiling (Picture 21). If flameproof cabinets are to be vented, the installation of the exhaust system must be equipped in a manner to prevent backflow. The National Fire Prevention Association (NFPA) does not require venting in flammable storage cabinets, however, if venting is done, it must be vented directly outdoors and in a manner not to compromise the specific performance of the cabinet (NFPA, 1996). In this configuration, it would not be expected that the cabinet would perform as designed in the case of a fire.

AHUs are normally equipped with filters that strain particulates from airflow. A bank of high-efficiency pleated air filters is installed inside each rooftop AHU. During a spot check of this equipment, one filter had become ajar, therefore creating a breach in this filter bank (Picture 22). In this condition, air can by-pass the filters and enter the building. Filter banks should have filters that are installed in a manner to prevent air bypass.

Volatile Organic Compounds (VOCs)

Indoor air quality can be negatively influenced by the presence of materials containing VOCs. VOCs are carbon-containing substances that have the ability to evaporate at room temperature. Frequently, exposure to low levels of total VOCs (TVOCs) may produce eye, nose, throat and/or respiratory irritation in some sensitive individuals. For example, chemicals evaporating from a paint can stored at room temperature would most likely contain VOCs. Material Safety Data Sheets (MSDS) of various cleaning compounds were examined by CEH staff. Of note were a variety of products that contain ethylene glycol monobutyl ether (butyl cellosolve) or petroleum distillates (e.g., mineral spirits, petroleum solvents, naptha) (Table 3). Both butyl cellosolve and petroleum distillates (a mixture of organic compounds derived from crude oil) may cause eye, nose and respiratory system irritation. Of the chemicals mentioned above, naphtha has an extremely low odor threshold. Levels as low as 1 part per million (ppm) can create odors (US NLM, unknown).

Of note was the use of a petroleum based dust mop treatment (Sheen), which was used on dry mops used to clean hallways and non-carpeted classrooms areas (MSDS for Sheen is attached as Appendix C). Use of petroleum-based products in a building should be avoided where possible or be used after school hours with a sufficient enough time to completely off-gas. According to Mr. Robinson, the BHS has converted to using a water-based dust mop head treatment (personal conversation with Craig Robinson, 2005).

Restrooms in some areas have mechanical exhaust vents that were not drawing air. Without active exhaust ventilation, restroom odors and moisture can penetrate into adjacent hallways and offices.

Conclusions/Recommendations

The indoor air quality of the BHS has improved since the previous MDPH assessment, which detailed water damage problems in the building. A number of indoor air quality issues remain. In order to address the conditions listed, recommendations to improve indoor air quality in the building are divided into **short-term** and **long-term** corrective measures. The short-term recommendations can be implemented as soon as practicable. Long-term recommendations are more complex and will require planning and resources to adequately address the overall indoor air quality concerns within the building. In view of the findings at the time of the visits, the following conclusions and recommendations are made:

Short Term Recommendations

1. Replace/repair any remaining water-stained ceiling tiles and building materials. Examine the area above and around these areas for mold growth. Disinfect areas of water leaks with an appropriate antimicrobial.
2. Discontinue use of pottery kilns until adequate exhaust ventilation can be installed.
3. Seal all vents that are part of the general HVAC system that exist in the kiln room.
4. Do not recycle clay until appropriate exhaust ventilation or provision of personal protective equipment is acquired.

5. Repair all damaged GW and seal the hallway ceiling plenum from classrooms. Do not use fibrous ceiling tiles as repair materials.
6. Remove water damaged carpeting in a manner consistent with recommendations found in "Mold Remediation in Schools and Commercial Buildings" published by the US Environmental Protection Agency (US EPA, 2001). Consider replacing carpeting with a non-slip, nonporous material (e.g., rubber matting, tile).
7. Continue to reduce or eliminate the use of petroleum-based cleaning materials.
8. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
9. Evaluate all restroom exhaust vents for function and repair as needed.
10. Connect the clothes dryers to the appropriate ceiling vents.
11. Examine all rooftop AHU filters monthly for proper installation.

Long Term Recommendations

1. Continue with plans to repair the roof.
2. Examine the feasibility of removing the hallway ceiling system. Consider replacement with a conventional ceiling system.
3. Install separate exhaust vents for each kiln.
4. Consider moving the spray booth to an exterior wall and use for clay recycling.

References

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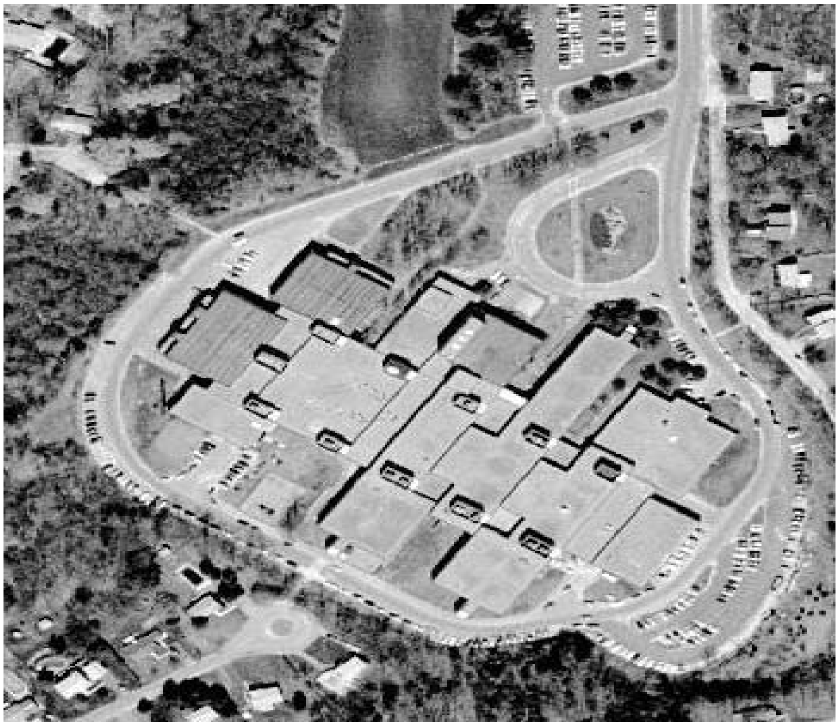
Picture 1



BHS is a Multiple Wing, Cement and Brick Structure

Picture 2

Each Wing is Connected by Two Long, Sloping Cement Corridors

Picture 3

Ceiling of Each Classroom

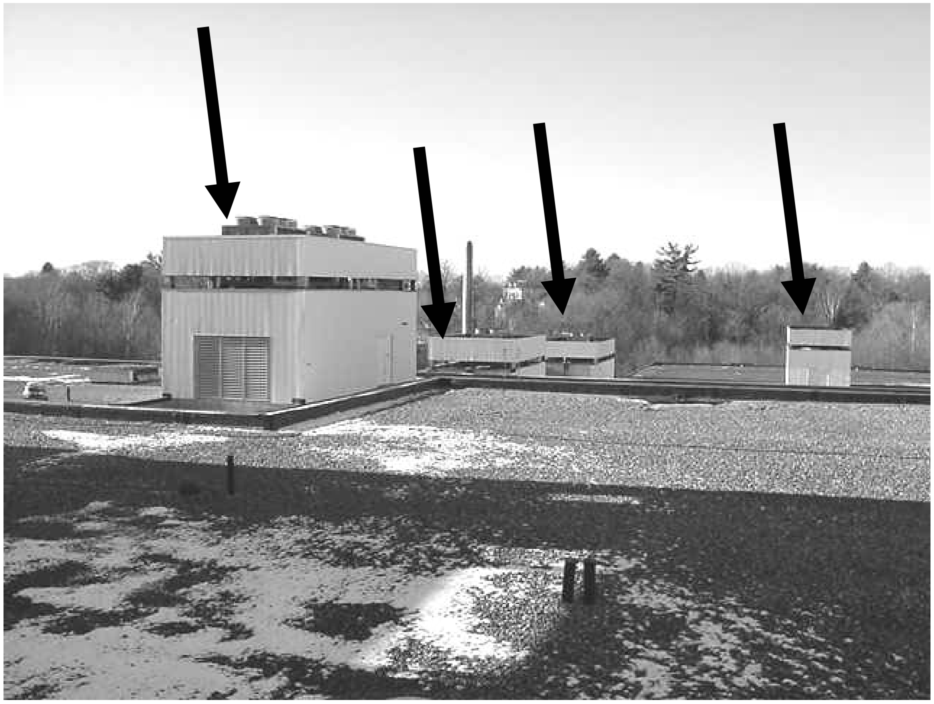
Picture 4

Space between the Classroom Hallway Walls and the Roof Deck Sealed With Gypsum Wallboard

Picture 5

Tamper-Proof Suspended Ceiling in the BHS Hallways

Picture 6

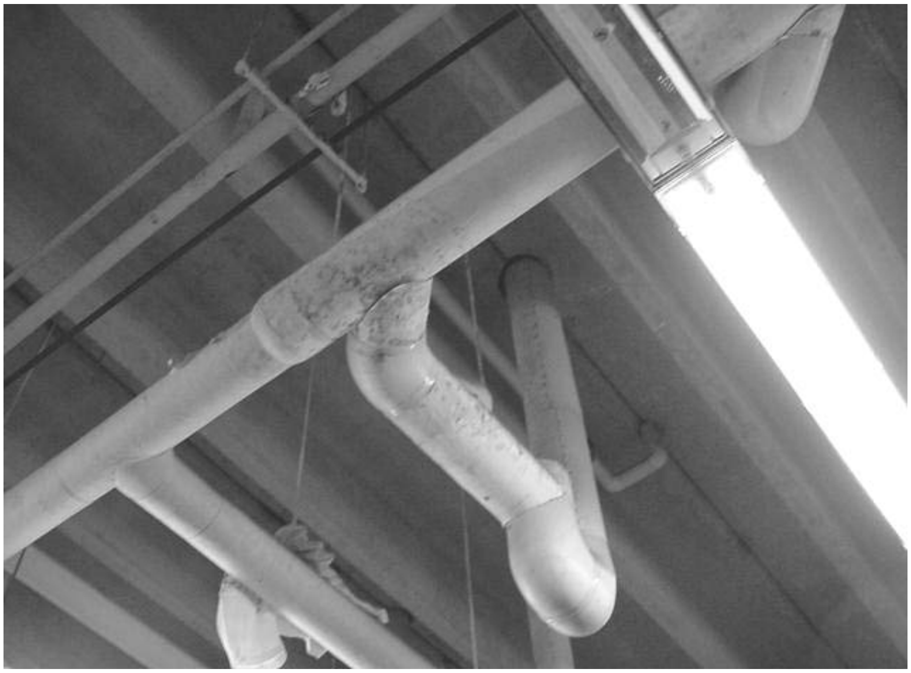


Rooftop AHUs

Picture 7

Retrofitted Fresh Air Supply Vents in Classroom

Picture 8



Water Damaged Pipe Insulation in Locker Room

Picture 9

Water Damaged Box, Science Prep Area

Picture 10

Water Damaged Ceiling System, Hallway

Picture 11

Water Damaged Carpet

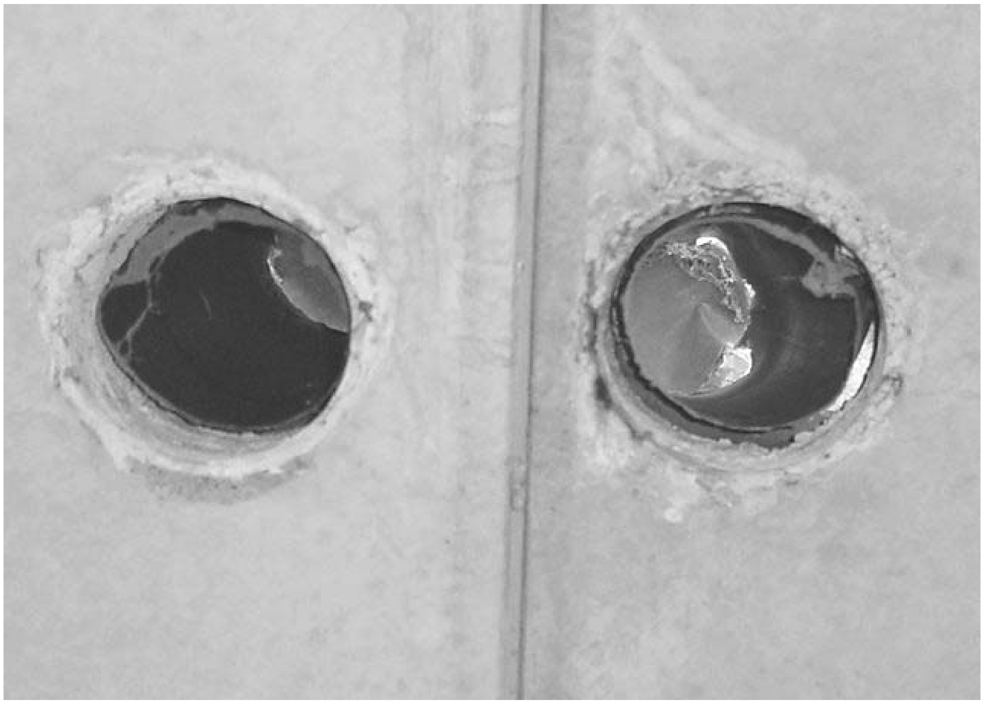
Picture 12

Dryer Venting Into Classroom

Picture 13

Abandoned Dryer Vents

Picture 14



Close-Up of Abandoned Dryer Vents, Note Light

Picture 15

Pottery Kilns and Spray Booth with Shared Exhaust Vent Ducts

Picture 16

General HVAC System Supply and Exhaust Vents in the Kiln Room

Picture 17

Damaged Gypsum Wallboard

Picture 18

Missing Sections of Gypsum Wallboard

Picture 19

Gypsum Wallboard Repaired Using Ceiling Tile

Picture 20

Flameproof Cabinet, Note Hose

Picture 21

Vent Connected to Flameproof Cabinet

Picture 22

Filter Bank in AHU, Note Ajar Filter

Burlington High School | **Indoor Air Results**

123 Cambridge St. Burlington, MA 01803 | **Table 1** | **Date: 09/30/2005**

Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Outside (Background)	356	71	30					
238	855	72	37	1	N	Y	Y	DEM
221	691	71	36	20	Y	Y	Y	Window Open, DO, DEM, 21 Computers
Art Room/Pottery	681	68	38	0	Y	Y	Y	Clay Recycling Table, DEM
224	727	69	40	26	N	Y	Y	DEM, DO, 17 Computers
222	520	71	37	2	Y	Y	Y	Window Open, DO, DEM, 14 Computers
134B	593	69	36	10	N	Y	Y	DEM
132	436	69	35	5	N	Y	Y	DEM

ppm = parts per million

AD = air deodorizer
AT = ajar ceiling tile

CD = chalk dust
CP = ceiling plaster
CT = ceiling tile
DEM = dry erase materials

GW = gypsum wallboard
MT = missing ceiling tile
PC = photocopier
PF = personal fan

PS = pencil shavings
TB = tennis balls
WB = wall breach
WD = water damage

Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Table 1-1

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123 Cambridge St. Burlington, MA 01803 **Table 1** **Date: 09/30/2005**

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						Supply	Exhaust	
Cafeteria	804	73	35	50+	Y	Y	Y	DO
207	561	69	34	18	Y	Y	Y	DEM, breaches around vents repaired with CT
206	897	69	38	24	Y	Y	Y	DEM, breaches around vents repaired with CT
Library	589	69	34	2	N	Y	Y	
146	573	67	33	0	N	Y	Y	WD-Carpet, WD-Tamperproof Ceiling
145	733	69	35	6	N	Y	Y	DO, 7 Computers, 1 PC
147	875	70	35	1	N	Y	Y	DO, 16 Computers
148	676	70	35	0	N	Y	Y	1 WD-CT, DO

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						Supply	Exhaust	
House B Reading Room	590	70	34	0	N	Y	Y	
155	709	71	33	1	N	Y	Y	DO
154	595	70	32	1	N	Y	Y	DO
152	574	69	32	0	N	Y	Y	
149	598	68	33	4	N	Y	Y	DO
203	846	69	37	21	Y	Y	Y	TB
211	626	69	36	2	Y	Y	Y	DO Window Open
219	927	70	37	12	Y	Y	Y	Sand box, pet mouse, DO
213	873	71	36	3	N	Y	Y	2 WD-CT, unvented dryer, DO

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Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
215	1168	71	36	15	N	Y	Y	DEM
217A	1091	71	36	23	Y	Y	Y	DEM, DO
217B	1168	71	36	13	N	Y	Y	DEM
214	1025	70	34	14	N	Y	Y	Unvented clothes dryer
Main lobby	666	69	35	2	N	Y	Y	
149E	668	69	34	2	N	Y	Y	2 WD-CT, DO
Band room	652	67	38	3	N	Y	Y	DO, Exhaust vent occluded with dust
192	650	68	38	3	N	Y	Y	

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Burlington High School | **Indoor Air Results**

123 Cambridge St. Burlington, MA 01803 | **Date: 12/08/2005**

Table 2

Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Outside (Background)	363	38	10					
215	825	70	16	14	N	Y	Y	2 WD-CT, DO, DEM
216	790	71	15	22	N	Y	Y	1 CT, 3 MT, DEM, WB, DO
217A	674	71	14	0	Y	Y	Y	7 WD-CT, 1 MT, DEM
217B	825	72	14	22	N	Y	Y	1 WD-CT, 1 MT, DEM, DO
218	811	73	14	20	N	Y	Y	1 AT, DEM, DO
201	656	72	12	12	Y	Y	Y	1 MT, DEM, WB, DO
202	606	72	12	10	Y	Y	Y	DEM, DO

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Table 2-1

Burlington High School **Indoor Air Results**

123 Cambridge St. Burlington, MA 01803 **Table 2** **Date: 12/08/2005**

Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
203	573	72	12	17	Y	Y	Y	DEM, TB
204	578	69	14	1	Y	Y	Y	24 computers, DO
205	594	72	13	13	Y	Y	Y	DEM, 3 WB, DO
206	532	71	11	5	Y	Y	Y	9 WB
207	496	71	11	1	Y	Y	Y	6 WB, 1 WD-CT, DEM
158	715	71	14	17	N	Y	Y	7 MT, 1 WD-CT, dry sink traps, DO
170	651	72	13	2	N	Y	Y	DEM, 1 AT, DO
169	554	70	12	0	N	Y	Y	

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						Supply	Exhaust	
168	589	71	13	0	N	Y	Y	DO
167	643	73	13	7	N	Y	Y	DO
166	647	71	14	3	N	Y	Y	Chemical hood, DO
166 (break area)	674	70	13	4	N	Y	Y	PC, 8 computers
166B	703	71	14	0	N	Y	Y	WD-cardboard, DO
173	778	72	14	21	N	Y	Y	Chemical hood, DO
172	740	73	14	23	N	Y	Y	Chemical hood, DO
Boy's locker room	-	-	-	-	-	Y	Y	WD-pipe insulation

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Burlington High School **Indoor Air Results**

123 Cambridge St. Burlington, MA 01803 **Table 2** **Date: 12/08/2005**

Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Zoo	755	78	17	3	N	Y	Y	DO
129	539	74	10	13	N	Y	Y	WD-insulation, WD-wall, 1 MT
Main office	541	72	11	2	Y	Y	Y	PC, 2 WD-CT, DO
211 (lounge)	798	72	15	0	Y	Y	Y	Plants, Cleaners, food
210	764	72	14	25	Y	Y	Y	Exhaust Vent Occluded With Dust, plants, DEM
209	802	72	13	22	Y	Y	Y	Dusty, DEM
208	728	72	12	22	Y	Y	Y	Clutter, DEM, breach in CT
161	761	72	11	9	N	Y	Y	CD, DO

ppm = parts per million

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PF = personal fan

PS = pencil shavings

TB = tennis balls

WB = wall breach

WD = water damage

Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
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Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Table 2-1

Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation Supply	Ventilation Exhaust	Remarks
162	604	72	10	0	N	Y	Y	breach in CT
163	639	74	11	1	N	Y	Y	temperature complaints, 3 WD-CT, MT, AD
164	730	73	12	0	N	Y	Y	WD-wall, plants
165	632	74	10	0	N	Y	Y	clutter, 5MT, 10 WD-CT
174	650	74	10	1	N	Y	Y	4 WB, dusty
177	615	75	9	0	N	Y	Y	4 WB, 5 MT, 21 computers
178 (Storage)					N	Y	Y	
179	639	74	9	2	N	Y	Y	2 WB, exposed insulation

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Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation Supply	Ventilation Exhaust	Remarks
156	626	72	9	0	N	Y	Y	3 MT/AT DEM odors, 4 WD-CT, WD-wall
157	711	72	11	15	N	Y	Y	missing vents
187	635	72	9	3	N	Y	Y	temperature complaints, missing tiles
188	553	71	9	1	N	Y	Y	
gym	598	69	11	29	N	Y	Y	
rubber gym	703	70	13	23	N	Y	Y	breach in wall
132	710	72	9	7	N	Y	Y	1 MT, slight odor
132 A/B	623	72	8	1	N	Y	Y	5 MT, PF-dusty, plants

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Location	Carbon Dioxide (*ppm)	Temp. (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
workshop storage	617	72	10	0	N	Y OFF	N	hood uncertified/off
130A	552	72	7	0	N	Y	Y	1 MT/AT
130B	659	72	8	1	N	Y	Y	1 MT/AT
Nurse's office	554	73	8	2	N	Y	N	3 WD-CT
Boy's infirmary	545	73	8	0	N	Y	Y OFF	5 WD-CT
Girl's infirmary	534	72	8	1	N	Y	Y	1 AT, 3 WD-CT
guidance copy room	563	72	8	1	N	Y	Y	3 Wet toner copiers
guidance main	554	72	8	0	N	Y	Y	

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						Supply	Exhaust	
105	584	72	9	1	N	Y	Y	1 copier
106	571	73	10	2	N	Y	N	window air conditioner-dusty
Hallway-business office	580	72	9					
Hallway-House A/B and Reading area	557	71	9					5 WD-CT
Hallway-House B and room 163	566	70	10					4 AT, 3 WD-CT
Hallway-room 165	593	72	10					30 WD-CT
Hallway-Receiving area	610	72	10					31 WD-CT, stained floor
Hallway-room 190	617	71	10					4 WD-CT

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123 Cambridge St. Burlington, MA 01803

Table 2

Date: 12/08/2005

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						Supply	Exhaust	
Hallway-rooms 156 and 179	617	69	10					
Hallway-auditorium	628	70	11					6 WD-CT
Hallway-library	621	70	11					
Hallway-cafeteria	642	70	10					6 WD-CT
Hallway-room 324	713	71	10					3 WD-CT
Hallway-room 239	716	71	11					1 WD-CT
Hallway-room 221	702	72	11					7 WD-CT
Hallway-room 244	700	70	9					

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						Supply	Exhaust	
Hallway-room 249	594	70	8					6 WD-CT
Hallway-room 255	643	71	9					8 WD-CT
Hallway-elevator and room 217A	831	70	12					10+ WD-CT
Hallway- K	822	71	12					
Hallway-room 207	684	72	10					

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Table 3
Products Used in Burlington High School

Manufacturer	Product Name	Hazardous Ingredients	Percentage of Product
Savin Products Company	Sheen	Petroleum solvent Paraffin oil	70 30
Sanford Corporation	Expo® Cleaner for Dry Erase Board	Isopropyl alcohol	
Core Products Co.	Unbelieveable!® Pro Carpet	Ethylene glycol monobutyl ether	
Core Products Co,	Hydroxi Pro® Carpet Cleaning Crystal	Hydrogen peroxide Alcohol ethoxylate	<6 <4
Johnson Diversey	Taski Wiwax	Alcohol ethoxylate	5
Johnson Diversey	Taski Omba	Diethylene glycol monoethyl ether Ethylene glycol	
Perma Inc.	Championship #210@50%	Stoddard solvent	
Colgate-Palmolive Co.	Ajax Concentrated Glass Cleaner	Ethylene glycol monobutyl ether Isopropyl alcohol	15 25
Lever Industrial Inc.	Taski R-50	Nonyl phenol polyethylene glycol ether Sodium alkylbenzene sulphonate	>1 >1
S.C. Johnson & Sons	Good Sense® SC	Sodium citrate Alkylphenoxy Polyethoxyethanol Fragrance Water	1-3 1-5 1-5 90-97
Synthetic Labs, Inc.	Heavy Duty Spotter HDS-11	Ethylene glycol monobutyl ether	3
Analab, Inc.	Heftee Blue	Ethylene glycol monobutyl ether	4.5
Texkem Inc.	Kleen All	Ethylene glycol monobutyl ether Potassium hydroxide	12 5
Amrep, Inc.	Misty All Purpose Cleaner	Ammonium hydroxide Isobutene Ethylene glycol monobutyl ether	
International Distribution Systems, Inc.	IDS Lemin Furniture Polish	Mineral spirits Naphtha, Hydrotreated Heavy (Isoparafinnic solvent) Polydimethylsiloxane Liquefied petroleum gas	4-5 5-10 2-3 5-10